

ASTUDY OF THE SIZES OF *ENTAMOEBACOLI* CYSTS AMONGST SYMPTOMLESS CARRIERS IN JAMAICA

BY

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An investigation of the cysts of *Entamoeba coli* was undertaken simultaneously with that of *Entamoeba histolytica* and on similar lines. The stools were obtained from two series of patients, three each of male and female, on alternate days, the patients being chosen from those in hospital for some condition other than an intestinal complaint. One series was sent up for examination on Mondays, Wednesdays and Fridays, the other on Tuesdays, Thursdays and Saturdays, for a period of three weeks.

It has been stated that, in contradistinction to the curve for *Entamoeba histolytica* cysts, the curve for the cysts of *Entamoeba coli* is unimodal, with the mode between 16μ and 17μ . Another statement which has been made is that 'the evidence upon the important question as to whether change in cyst size [of *Entamoeba coli*] occurs from day to day is insufficient.' The data founded on the following series of cases, though not very extensive, may offer a little evidence to help in the solution of this question.

As in the case of *histolytica*, each patient from whose faeces a considerable number of cysts was measured will be mentioned separately, and then a curve will be given for the whole number.

I. This patient exhibited both *coli* and *histolytica* cysts in considerable numbers; the latter have been dealt with in a previous paper. As regards the *coli* cysts, one hundred and thirty-four were measured on the first occasion; among these the size most frequently met with was 16.6μ in diameter, and the mean for the whole was 17.4μ . At none of the subsequent examinations, in spite

of the fairly abundant presence of *histolytica*, were *coli* cysts plentiful; in fact, they became less and less frequent at each examination. Thus, on the next occasion on which they were found only fifty were measured, and a prolonged search resulted in finding twenty and five respectively at the next two examinations.

FIG. 1. Showing size of *E. coli* cysts (134). Case I.

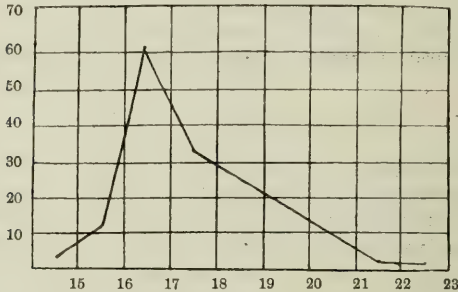
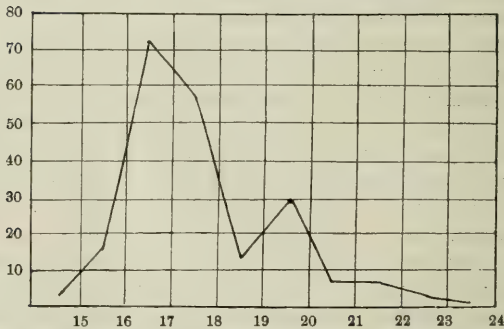


FIG. 2. Showing size of *E. coli* cysts (209). Case I.



II. The second case left hospital after two examinations had been made, in both of which *Giardia* and *coli* cysts were fairly numerous, particularly the former. On the first occasion one hundred and fifteen *coli* cysts were measured, and on the second one hundred. The curves for these and for the total are given below. At the former examination those most frequently met with had a diameter of 22.7μ , but these only exceeded those with a diameter of 19.8μ

by one, with a mean of 20.4μ ; at the second, those of 19.8μ were most numerous, and the mean of the one hundred was 19.9μ .

FIG. 3. Showing size of *E. coli* cysts (115). Case II. First examination.

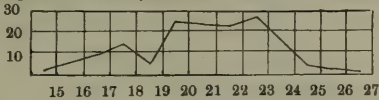


FIG. 4. Showing size of *E. coli* cysts (100). Case II. Second examination.

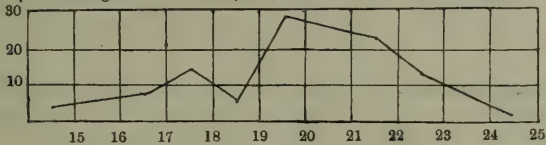
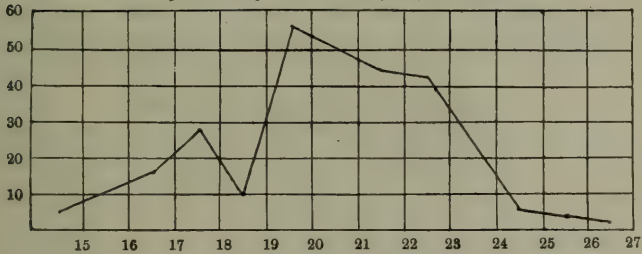


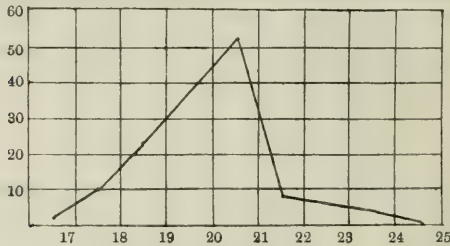
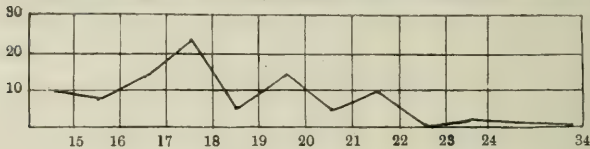
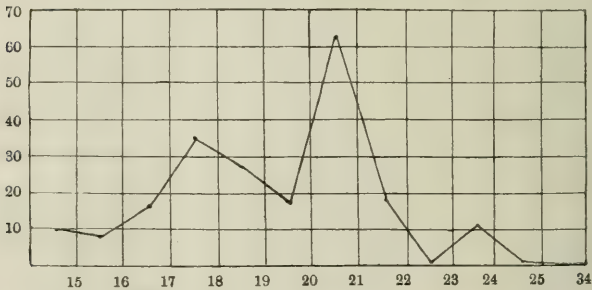
FIG. 5. Showing size of *E. coli* cysts (215). Case II.



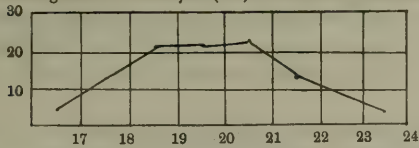
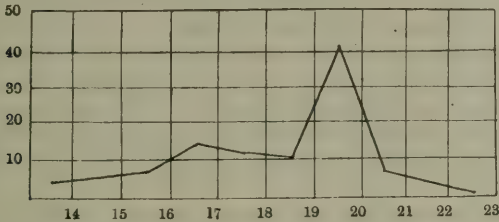
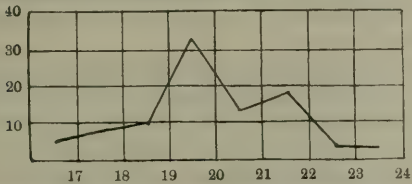
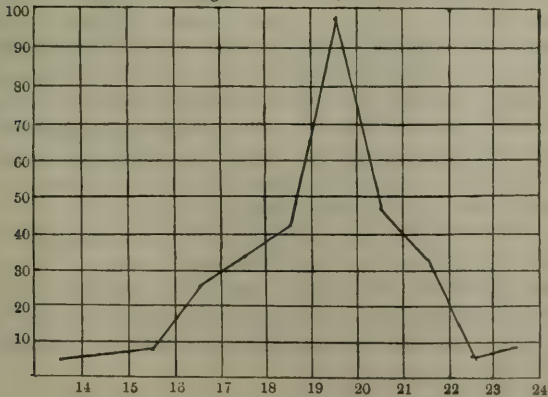
III. At the first examination of faeces from this patient several specimens and prolonged search revealed only seven *histolytica* and three *coli* cysts. Two days later there was a different picture; *coli* cysts were many, *Giardia* and *Chilomastix* were in considerable numbers, while no *histolytica* were seen at all.

Again, after an interval of two days no *Giardia* were found, there were a few *Chilomastix*, three *histolytica* and four *coli* cysts after long search. For the next week only *Giardia* was found, and then *coli* were again numerous, as were also *Chilomastix* and *Giardia*, and a few *histolytica*.

On the first occasion, where one hundred and two cysts were measured, those most frequently met with had a diameter of 20.3μ , the mean being 20.1μ ; at the last examination 17.8μ were the most frequent, and the mean was 18.17μ .

FIG. 6. Showing size of *E. coli* cysts (102). Case III. First examination.FIG. 7. Showing size of *E. coli* cysts (100). Case III. Second examination.FIG. 8. Showing size of *E. coli* cysts (214). Case III.

IV. The fourth patient's stools contained *coli* cysts on several occasions, and in large numbers on some. On three of these one hundred or more were measured, and the relative proportions of the various sizes are shown in the accompanying curves. Those occurring most frequently were 20.9μ , 19.8μ , and 19.8μ , respectively with corresponding means of 19.8μ , 19.2μ , and 19.9μ , considerably larger than the usual mean of 16μ to 17μ given for *coli* cysts in general.

FIG. 9. Showing size of *E. coli* cysts (102). Case IV. First examination.FIG. 10. Showing size of *E. coli* cysts (100). Case IV. Second examination.FIG. 11. Showing size of *E. coli* cysts (100). Case IV. Third examination.FIG. 12. Showing size of *E. coli* cysts (309). Case IV.

The following eleven cases exhibited *Entamoeba coli* cysts in their faeces, but not sufficiently often for large numbers to be measured on several occasions; a total of over one hundred was measured from each, and, therefore, a brief remark on them is warranted.

V. This patient has already been mentioned in the paper on the measurement of cysts of *histolytica*, as she was passing both *histolytica* and *coli* in considerable numbers, but, except on one occasion, the former were in greater numbers.

At the first examination at which cysts were found, there was a proportion of four *histolytica* to one *coli*. In measuring one hundred of the former only twenty-two of the latter were encountered. Of these the size most frequently met with (six in all) had a diameter of about 21μ (between $21\cdot1\mu$ and $21\cdot5\mu$; the average for the whole was $20\cdot1\mu$).

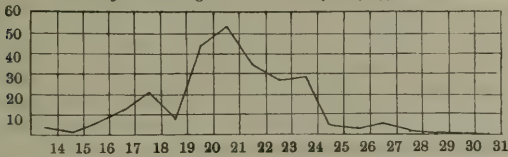
At the second examination prolonged search revealed only six *coli* cysts, varying from $19\cdot1\mu$ to $21\cdot1\mu$ in diameter, with a mean of $20\cdot23\mu$. On this occasion prolonged and repeated search yielded no *histolytica* cysts at all.

Two days later *histolytica* were again numerous while *coli* were very scarce, only three being encountered during the time that one hundred *histolytica* were measured. Yet again, after two more days, though *histolytica* were fairly numerous, they did not exceed the *coli* in such proportion, seventy-six of the latter being found to one hundred and twenty-five of the former. On this occasion the average size of the cysts was large, namely, $21\cdot06\mu$, the most commonly occurring being $22\cdot4\mu$, of which there were eleven, while of $20\cdot5\mu$ and $23\cdot7\mu$ there were ten each. Two days later they were present in about the same proportion, seventy-two *coli* to one hundred and thirty *histolytica*; some *coli* both larger and smaller than on previous occasions were found, but otherwise the numbers were fairly evenly distributed, the mean for the whole being $20\cdot1\mu$, the highest number being nineteen between 20μ and 21μ .

At the next examination *coli* were present in a proportion of one to three (thirty-three *coli* to one hundred *histolytica*). There is nothing particular to remark about them on this occasion; the most commonly occurring had a diameter of $20\cdot7\mu$, while only one less were $20\cdot1\mu$ on the one side and $22\cdot5\mu$ on the other; the average for the whole was $21\cdot47\mu$.

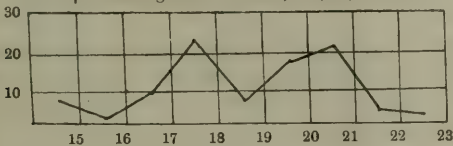
At the last time of examination there were rather more *coli* than *histolytica* (fifty-five to forty), the most common was 19.6μ , and the mean of the whole was 19.79μ .

FIG. 13. Showing size of *E. coli* cysts (267). Case V.



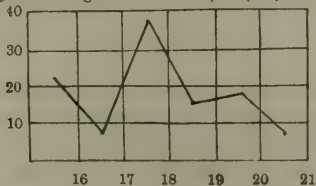
VI. In this patient *coli* cysts in considerable number were found on one occasion only, though *histolytica* were met with more frequently. When they were in sufficient numbers one hundred were measured, and the curve below gives the various sizes encountered. It is a matter of regret that during this patient's subsequent stay in hospital these cysts were not again found, because it would have been interesting to see whether this bimodal form of curve persisted, in contrast with what usually obtains in infections with *Entamoeba coli* cysts.

FIG. 14. Showing size of *E. coli* cysts (100). Case VI.



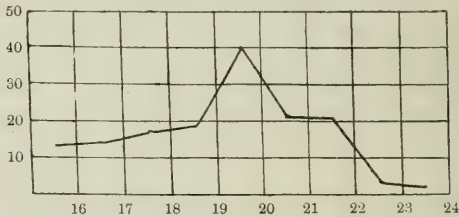
VII. This patient left hospital after one examination had been made; at this, however, one hundred and eight *coli* cysts were measured, of which the diameter of the most frequently occurring was 17.9μ , with 17.5μ only one less, and the mean was 17.8μ . The curve of these is given (fig. 15).

FIG. 15. Showing size of *E. coli* cysts (108). Case VII.



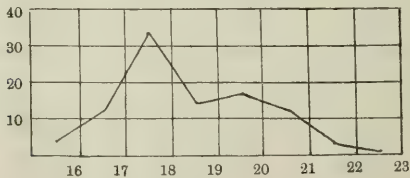
VIII. On two occasions only were *coli* cysts found in any numbers; on the first of these one hundred were measured, on the second fifty. At subsequent examinations merely three or four were found, and sometimes none at all. These two occasions were but two days apart, and it is interesting to note the difference in the prevailing size. Thus, with the first one hundred the diameter of those most frequently met with was 19.2μ and the mean was 19.75μ , while at the second time of examining the commonest was 15.9μ and the mean 17.83μ . These wide differences illustrate remarkably the errors possible from the measurement of small numbers of cysts. The curve for the whole one hundred and fifty is given here (fig. 16).

FIG. 16. Showing size of *E. coli* cysts (150). Case VIII.



IX. After several negative examinations *coli* cysts were found in this patient's stool on one occasion when one hundred were measured. The most common had a diameter of 17.8μ with 19.8μ only one less, and the mean was 18.4μ .

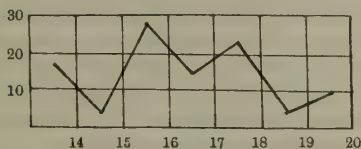
FIG. 17. Showing size of *E. coli* cysts (100). Case IX.



X. This patient unfortunately left hospital just after the first positive examination. *Coli* cysts were fairly numerous, one hundred being measured, but the noteworthy point is the tendency for the majority to be of a somewhat small size, as shown by the

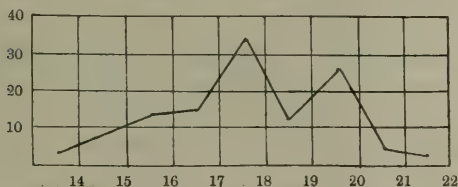
accompanying curve, though the mean for the whole works out at 16.2μ . It is a matter for regret that I was not able to follow up this patient and obtain further specimens.

FIG. 18. Showing size of *E. coli* cysts (100). Case X.



XI. Cysts were never very numerous in this case and were present intermittently, at least were only discovered intermittently. One hundred and ten cysts were measured, of which the curve is given (fig. 19).

FIG. 19. Showing size of *E. coli* cysts (110). Case XI.

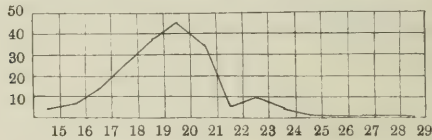


XII. *Coli* cysts were found on nearly every occasion in this case, but not in large numbers; sometimes a bare half-dozen or so after prolonged search, but on three occasions fifty were measured. On the first and second of these the diameter of cyst most frequently met with was 19.8μ , but on the third only 17.6μ . The number investigated was not sufficient to enable one to say whether this was a mere accident or error in sampling, but the smaller size was encountered on the last occasion on which they were found prior to the patient's departure from hospital.

It is a matter of conjecture as to whether immature cysts were being expelled before their final disappearance, or whether, as a corollary of Dobell's statement—that emetine-resistant *histolytica*

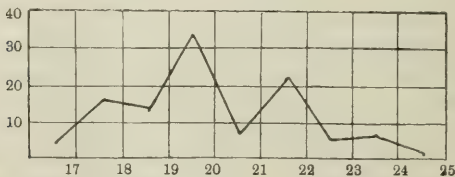
cysts, or cysts appearing after a course of emetine, are inclined to be larger than before—when the patient is getting the better of his infection, the cysts may diminish in size. One must not, of course, lose sight of the fact that *histolytica* infections are pathogenic whereas *coli* probably are not. It may also be remarked, however, that in this patient some of the largest met with in the investigation were encountered during the last three or four examinations; while the largest during the first ten days' examinations was 24.4μ , towards the last eight days there were seen a few as large as 26.3μ , 27.1μ and 28.3μ , but with only eight nuclei. Fig. 20 gives the curve for the total of one hundred and ninety-five cysts measured in this case.

FIG. 20. Showing size of *E. coli* cysts (195). Case XII.



XIII. In the stools from this patient cysts were scarce, but were measured from time to time when seen, a total of one hundred and nineteen cysts being obtained. The curve from this case is given (fig. 21). The most frequent was 19.6μ , and the mean 20.1μ .

FIG. 21. Showing size of *E. coli* cysts (119). Case XIII.



XIV. From this patient only sixty *coli* cysts were measured on two occasions. The size most frequently met with had a diameter of 17.2μ , and the mean was 18.1μ .

XV. Cysts were found but once only in this patient's stools and

fifty were measured; twenty of them had a diameter of 17.6μ , and the mean of the total worked out at 17.73μ .

In all, two thousand five hundred *Entamoeba coli* cysts have been measured, and the charts below show the various sizes met with. From these curves it will be noticed that instead of a unimodal curve with mode between 16μ and 17μ , it is distinctly bimodal, with modes between 17μ and 18μ and between 19μ and 20μ .

Figs. 1, 6, and 20 show the unimodal type; fig. 2 shows in addition a smaller increase again between 19μ and 20μ ; the majority of the rest show a bimodal graph, as stated above (figs. 5, 11, 19, for example); when the tendency is to be unimodal the mode is between 19μ and 20μ (figs. 12, 16, 20); in figs. 8 and 13 the majorities are between 17μ and 18μ and 20μ and 21μ , while fig. 17 is unimodal between 17μ and 18μ ; fig. 21 shows yet another form.

No inference of value can be drawn from the individual curves of these cases, for the numbers in each are too small, but the graph of the whole two thousand five hundred (fig. 23) brings out the point clearly that, judging from the present findings, the graph of the sizes of *Entamoeba coli* cysts is also bimodal, both modes being at a higher level than has been recorded at home, namely 17μ to 18μ and 19μ to 20μ , instead of between 16μ and 17μ .

FIG. 22. Showing size of *E. coli* cysts (2,500).

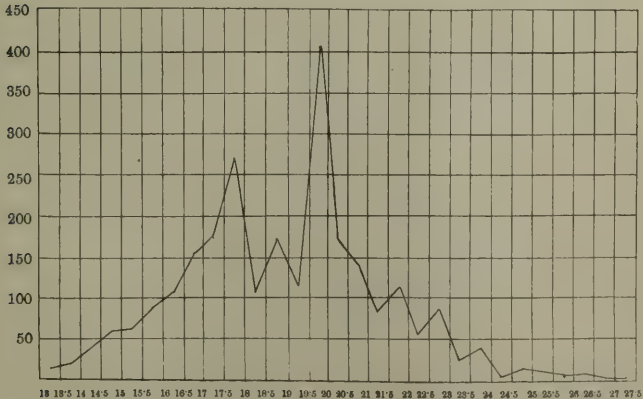


FIG. 23. Showing size of *E. coli* cysts (2,500).